Hevea Research Platform in Partnership

INNOVATIVE TAPPING SYSTEMS TO IMPROVE PRODUCTIVITY OF THAI RUBBER PLANTATIONS

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World rubber cultivation: A changing context

Industrial estates

Due to increasing scarcity of skilled manpower or tappers,

labor productivity is maximized by using reduced tapping frequencies: d/3, d/4, d/5, d/6

World rubber cultivation: A changing context

Smallholdings: evolution is opposite

Plantations owners try to compensate the small size of their farms through tapping intensification:

d/2, 2d/3, 3d/4, d/1

This leads to a low tapping productivity resulting from physiological fatigue, tapping panel dryness and reduces the plantation lifespan

Thai rubber plantations

- **Mainly smallholdings with very small size (< 2 ha)**
- **High tapping frequencies: 2d/3, 3d/4, 5d/6, d/1**
- **Shortened cut length: 1/3 S**

The entire plantation = one tapping task on which tapping is performed every day…

Thai rubber plantations

- **Crop-sharing system (tapper 40%, owner 60%) favours acceleration of tapping by the tappers.**

- **Replanting regulations: also push for intensive tapping, since planters can apply to replanting subsidies when bark is not available anymore.**

Thai rubber plantations

Consequences of intensive tapping systems

- **Overexploitation of the trees → physiological fatigue**
- **High tapping panel dryness (TPD) rates**
- **Short life-cycle of the plantations (high bark consumption)**
- **Low tapper and planter incomes compared to the potential**

Physiological and practical causes for this low productivity

- **Insufficient time for latex regeneration between consecutive tappings, preventing the use of Ethephon stimulation because of a too low latex sugar content**
- **Use of 1/3 spiral cut, often leading to a huge “island bark” on third panel (B0-3)**
- **Increasing trend to early opening of small trees**
- **Impossibility to use controlled upward tapping**

How to improve productivity of Thai rubber plantations in a sustainable way?

Testing and developing innovative tapping systems

Reduced tapping frequencies (RTF)

Double Cut Alternative (DCA)

“Improving the Rubber Tree Productivity”

a Thai-French Cooperation since 1998

RRIT-DOA **KU** **CIRAD** **PSU**

Hevea Research Platform in Partnership (HRPP)

Created in May 2008

Experimental sites

- **Chachoengsao:**

  3 on-station trials (2 on RRIM600 in 2000 + 1 on BPM 24 in 2007)

- **Chantaburi:**

  3 on-farm trials on RRIM600 (2004, 2005, 2007)

- **Songkhla:**

  1 on-station trial on BPM24 (2006)

  1 on-station trial on RRIM600 (2007)

  8 on-farm trials on RRIM600 (2 in 2007 + 6 in 2008)

Reduced Tapping Frequencies (RTF)

On-Farm experiment at Chantaburi

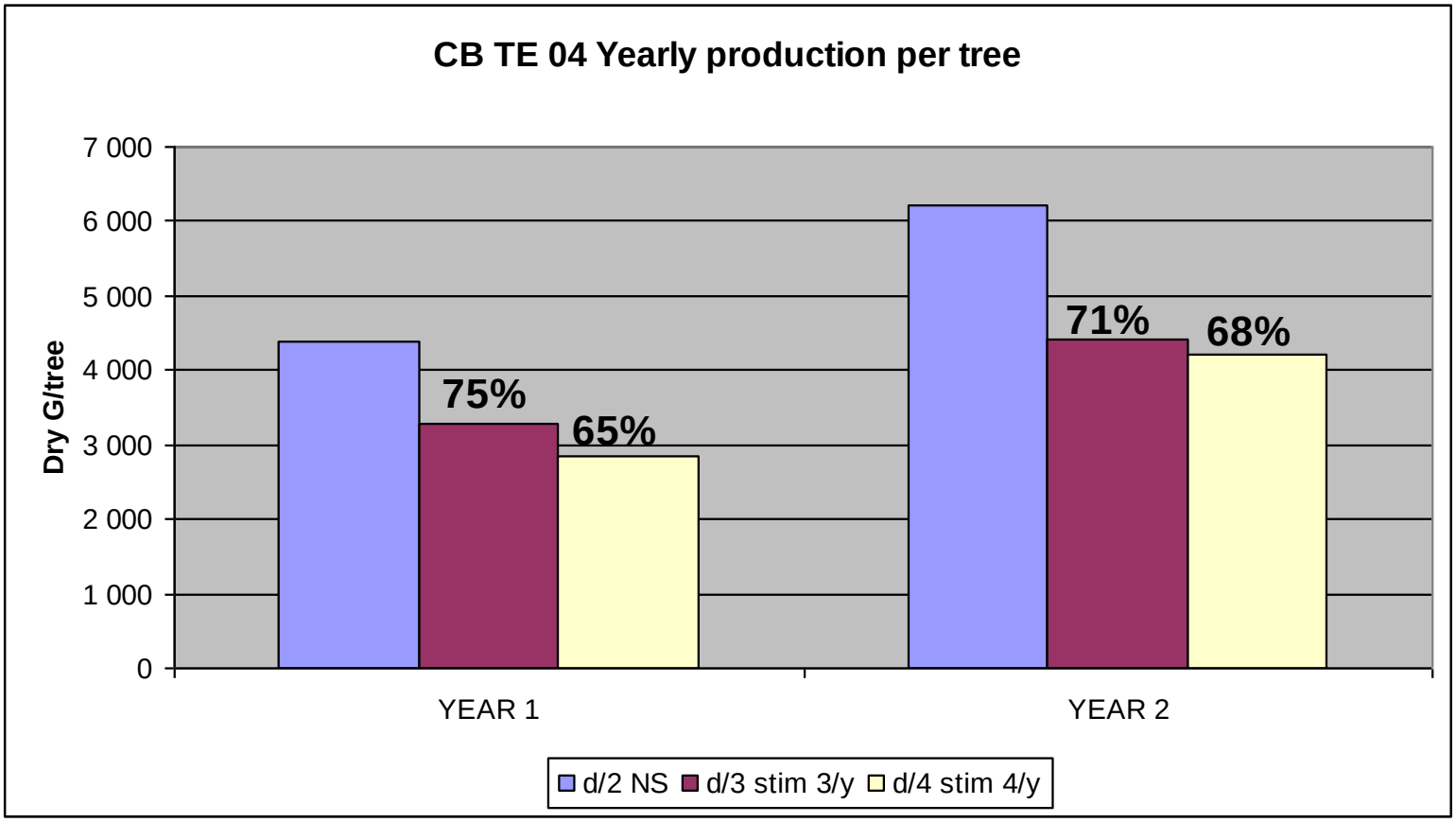
- Clone RRIM 600 planted in May 1998
- Tapping started in October 2005
- Current tapping system: 1/2 S d/2 (no stimulation) – No trial
- Trial started on 13/03/07 (1.5 years after opening)
- The 3 following treatments were studied:

A – 1/2 S d/2 (nil stim) (control)

B – 1/2 S d/3 + stim 3/y ***(May, Aug., Sept.)***

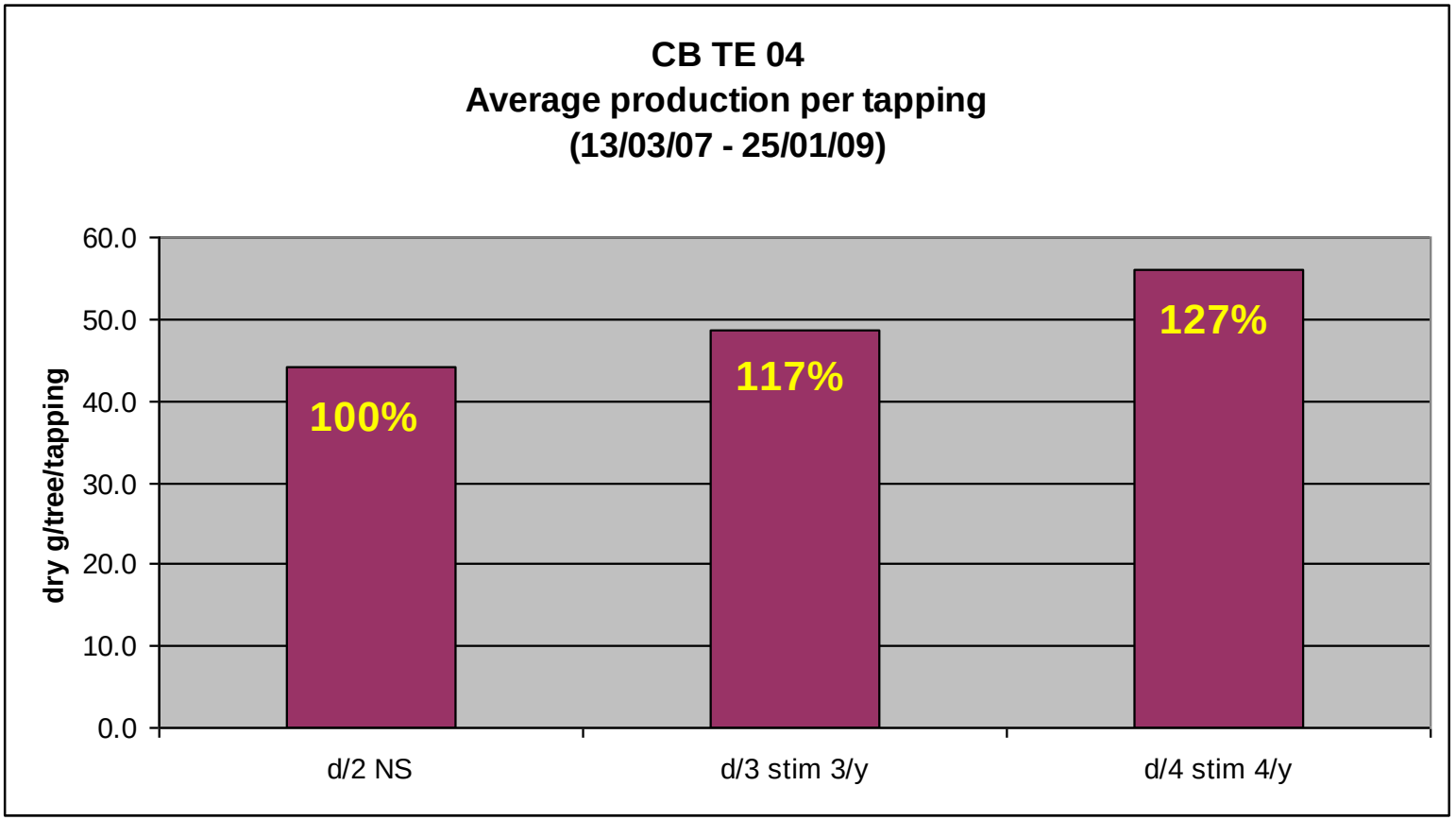
C – 1/2 S d/4 + stim 4/y ***(May, July, Sept., Nov.)***

RTF Results: Production per tree



Over the 2 first years of experiment, the production of stimulated trees with RTF could not reach the production of control trees tapped in 1/2S d/2 without stimulation

RTF Results: labour productivity



In terms of work productivity (g/tree/tapping)
1/2S d/3 + stim. increased productivity by +17%
1/2S d/4 + stim. increased productivity by +27%

RTF Results: Number of tappings

CB TE 04 Tapping Schedule for period 13/03/07 to 25/01/09 (Year 1 + Year 2)

		Number of tappings			Missed Tapping Days		
N°	Treatment	Scheduled	Actual	Achieved	Total	Rain	%
A	1/2S d/2 non stim	325	240	74%	85	69	81%
B	1/2S d/3 stim	217	159	73%	58	48	83%
C	1/2S d/4 stim	163	126	77%	37	30	81%

During the period March 2007 to January 2009, an important number of tapping days were lost (23 to 27%), mainly due to rain at the time of tapping (81 to 83% of missed tapping days) for all treatments.

Lost tapping days induce important consequences in terms of yield, particularly for the RTF treatments.

Importance of recovery tappings!

RTF Results: Recovery tappings

Over 2 years, estimated numbers of possible recovery tappings in the experiment were:

38 for d/3 = 197/217 scheduled (91%)

27 for d/4 = 153/163 scheduled (94%)

CB TE 04 Estimated Yield with Recovery Tapping (Year 1 + Year 2)

		Recovery Tapping			Estimated Yield (cum g/t)		
N°	Treatment	Nb.	g/t/t	Add. Yield (g)	Actual	Total	%
A	1/2S d/2 non stim				10 620	10 620	100%
B	1/2S d/3 stim	19 / 19	45.0/48.7	1 780	7 701	9 481	89%
C	1/2S d/4 stim	13 / 14	49.0/56.0	1 421	7 051	8 472	80%

With recovery tappings, the estimated yield of RTF could reach:

89% of control for d/3

80% of control for d/4

RTF: Preliminary conclusions

The main conditions for success of RTF associated with Ethephon stimulation in terms of yield and productivity are:

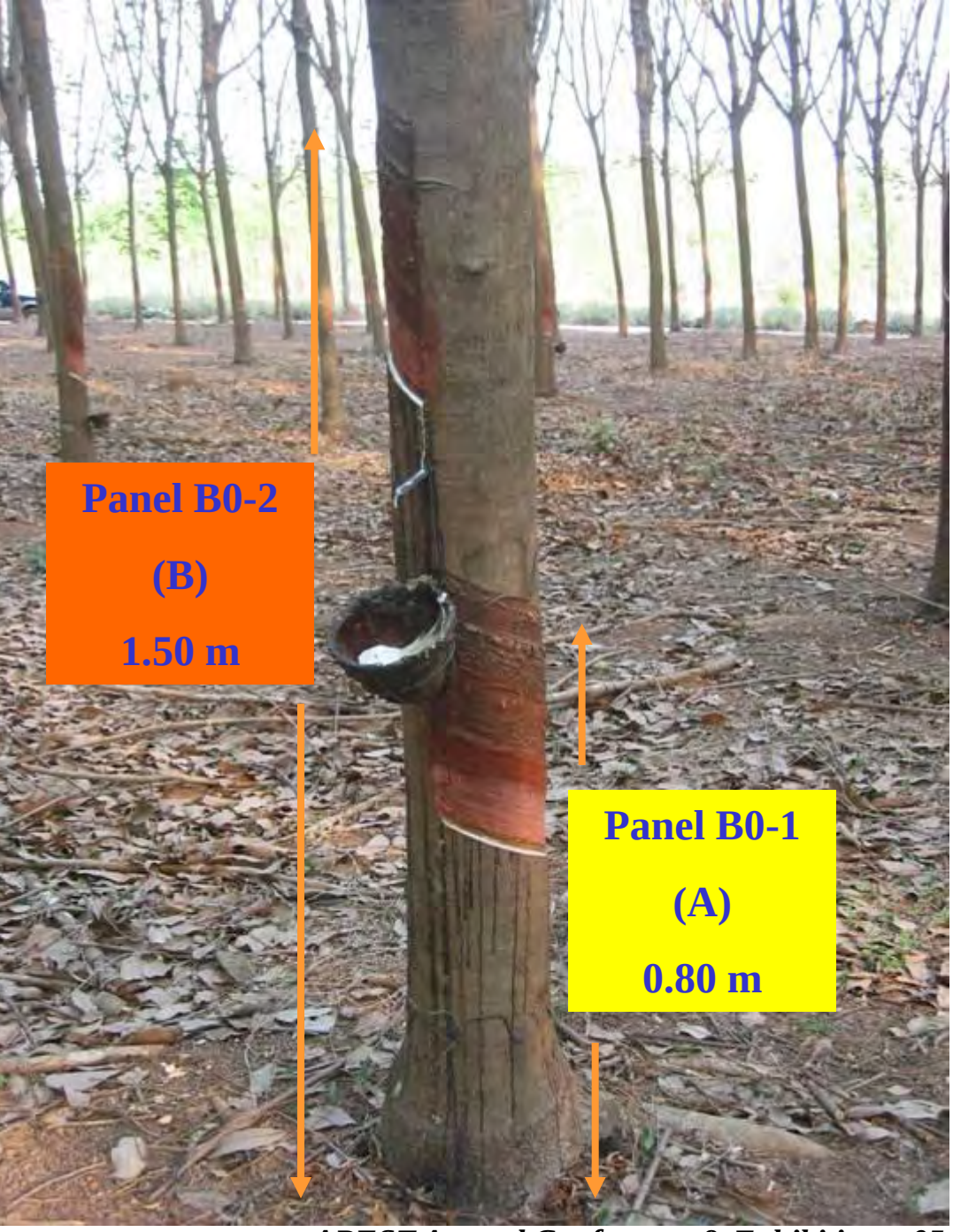
- **the practice of recovery tappings (the day after)**
- **cup lumps management (if any)**
- **possible use of rain-guards**
- **time of tapping**
- **choice of adapted clones…**

In the current tapping management of most Thai rubber plantations, RTF cannot be recommended on a large scale and trials must be continued to improve their feasibility…

“Double Cut Alternative” (DCA)

In the context of low tapping productivity, this new tapping strategy has been firstly implemented and tested from 2000 onwards at the Chachoengsao Rubber Research Center (CRRC), then in different on-farm trials.

Aim = to optimize high tapping frequencies by splitting tapping on two different cuts, tapped alternately, in order to increase latex regeneration time in the bark.



DCA
Tapping Strategy

2 x 1/2 S d/4 (t,t)
(equivalent 1/2 S d/2)

The 2 cuts should be located on opposite tapping panels and vertically as distant as possible to reduce their possible competition regarding carbohydrates, water and mineral supply

Both panels are used together and alternately from the opening

DCA Tapping Strategy

The principle of DCA is to split the single tapping cut into two on the same tree:

			TAPPING SEQUENCE												
TAPPING FREQUENCY (7d/7)			Mon	Tue	Wed	Thu	Fri	Sat	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Sun
Standard	d/2		T		T		T		T		T		T		T	
DCA	2 x d/4	High	T				T				T				T	
		Low			T				T				T			

2 x 1/2S d/4 (t,t) = equivalent to 1/2S d/2

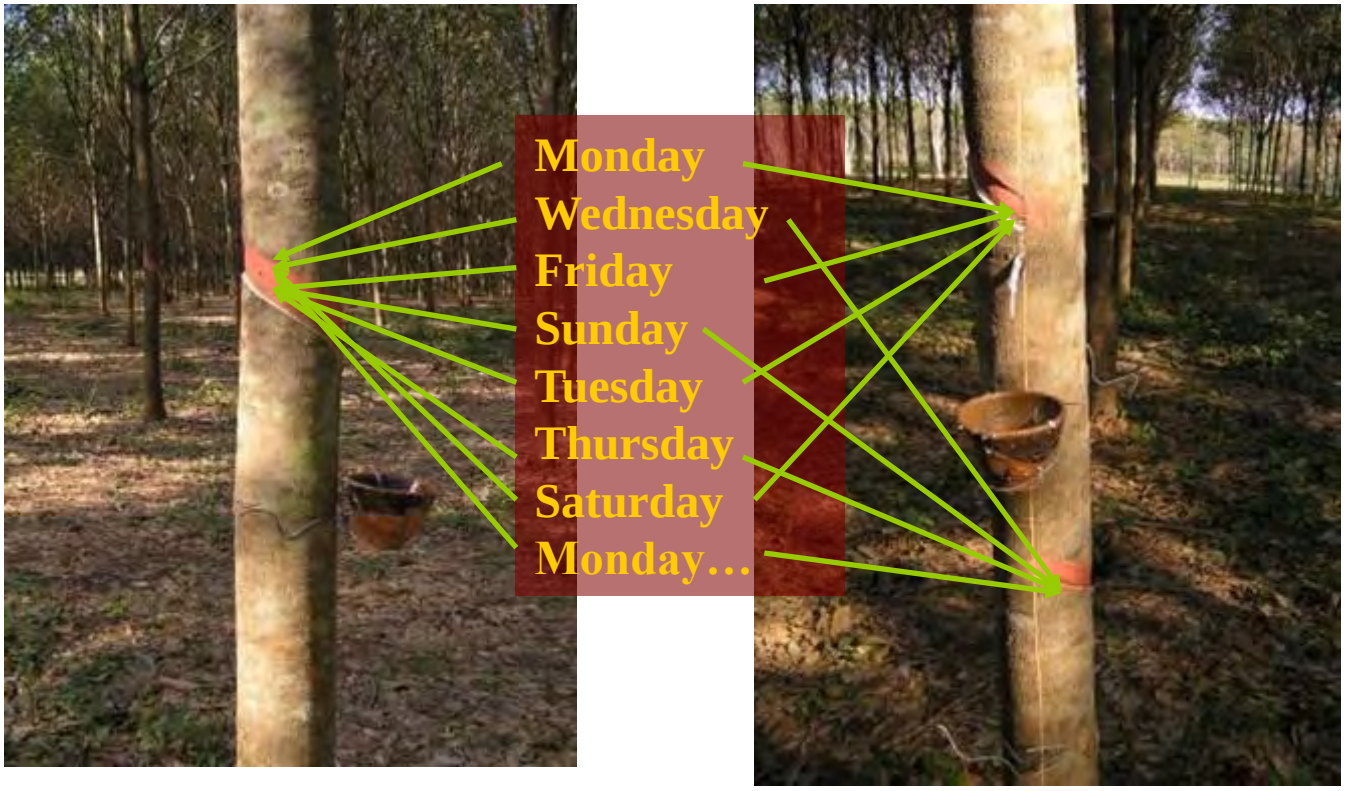
At tree level, tapping frequency is maintained in d/2, 7d/7

While the tapping frequency remains the same for the tree, the regenerating time is twice as much for each of the two cuts.

DCA Tapping Strategy

DCA applied on 1/2 Spiral d/2 (7d/7)

1/2S d/2 **2 x 1/2S d/4 (DCA)**



Application of DCA tapping system

to higher tapping frequencies:

1/3S 2d/3 (7d/7)

			TAPPING SEQUENCE												
TAPPING FREQUENCY (7d/7)			Mon	Tue	Wed	Thu	Fri	Sat	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Sun
Standard	2d/3		T	T		T	T		T	T		T	T		T	T
DCA	2 x d/3	High	T			T			T			T			T	
		Low		T			T			T			T			T

DCA: 2 x 1/3S d/3 (t,t) = equivalent to 1/3S 2d/3

At tree level, tapping frequency is maintained in 2d/3, 7d/7

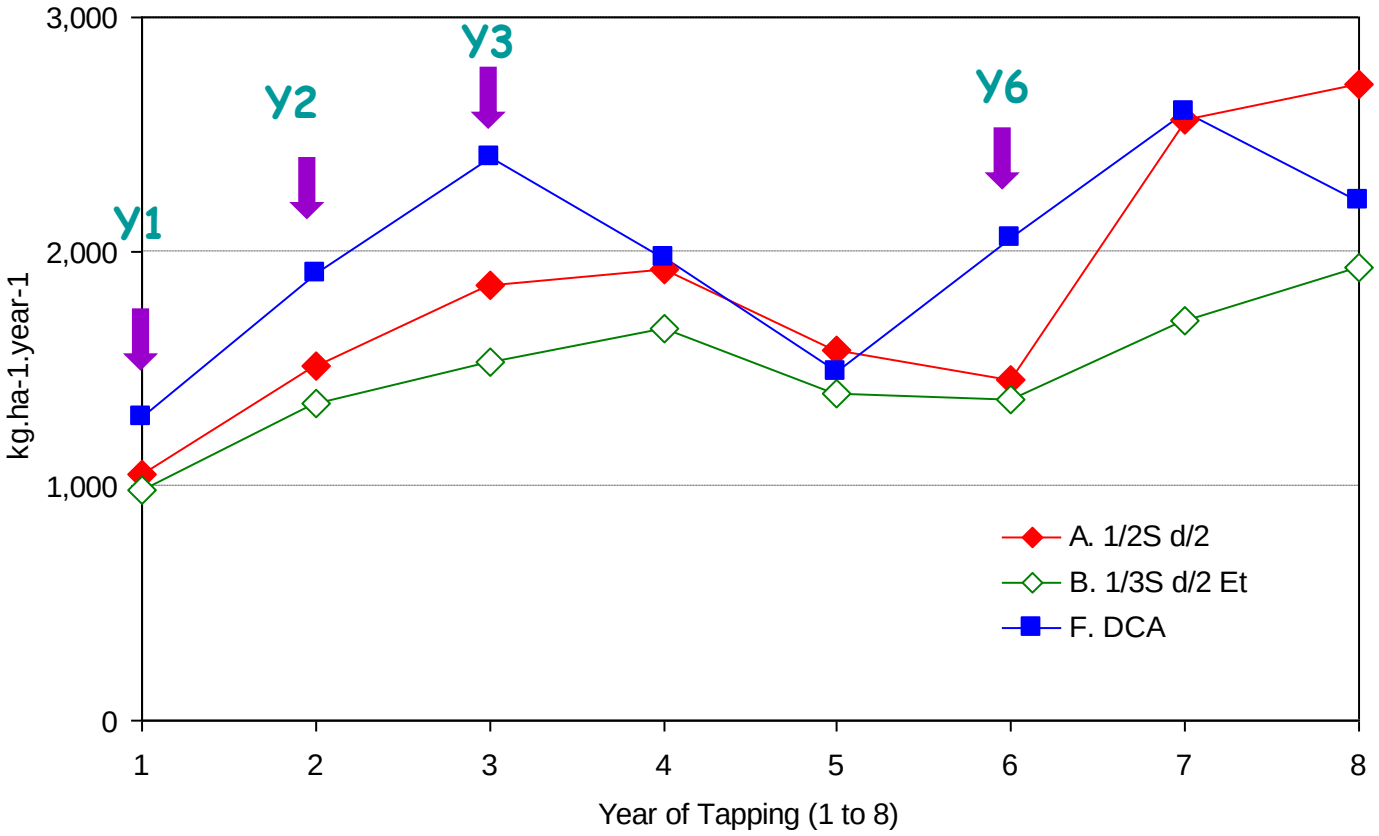
Application of DCA tapping system to high tapping frequencies: 1/3S 3d/4 (7d/7)

			TAPPING SEQUENCE												
TAPPING FREQUENCY (7d/7)			Mon	Tue	Wed	Thu	Fri	Sat	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Sun
Standard	3d/4		T	T	T		T	T	T		T	T	T		T	T
DCA	2 x d/2 (1/3) d/3 (2/3)	High	T		T			T			T		T			T
		Low		T			T		T			T			T	

DCA: 2 x 1/3S d/2 (1/3) + d/3 (2/3) (t,t) = equivalent to 1/3S 3d/4

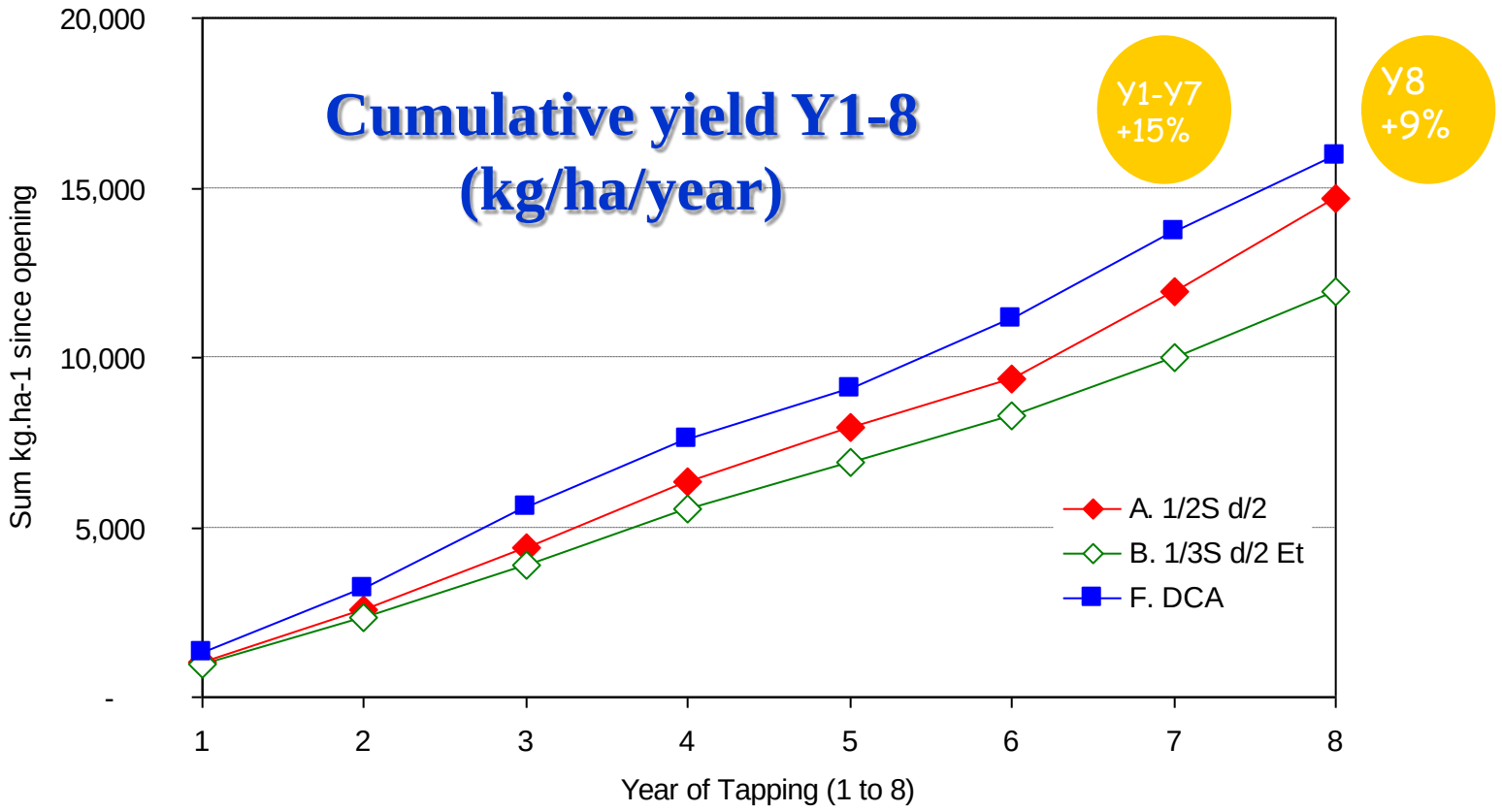
At tree level, tapping frequency is maintained in 3d/4, 7d/7

DCA: Results Chachoengsao



DCA provided a significant yield improvement compared to the two recommended systems (1/2 S d/2 nil stim and 1/3 S d/2 Et 2.5% 4/y) especially in Years 1, 2, 3 and 6

DCA: Results Chachoengsao



DCA: significantly higher until end of year 7 (+15% since opening)

Although not anymore significant after 8 years of tapping, cumulative kg/ha of DCA still represented an observed increase of +9% over 1/2S d/2

DCA: on-farm trial at Chantaburi
Experimental plots and treatments

- Plot planted in 1997, clone RRIM 600
- Started to be tapped (trial) in October 2004 (7 years)
- Current tapping system: 1/3 S 2d/3 (no stimulation)
- The DCA was implemented taking 1/2 S d/2 and 1/3 S 2d/3 tapping systems as controls
- The 4 following treatments were studied:

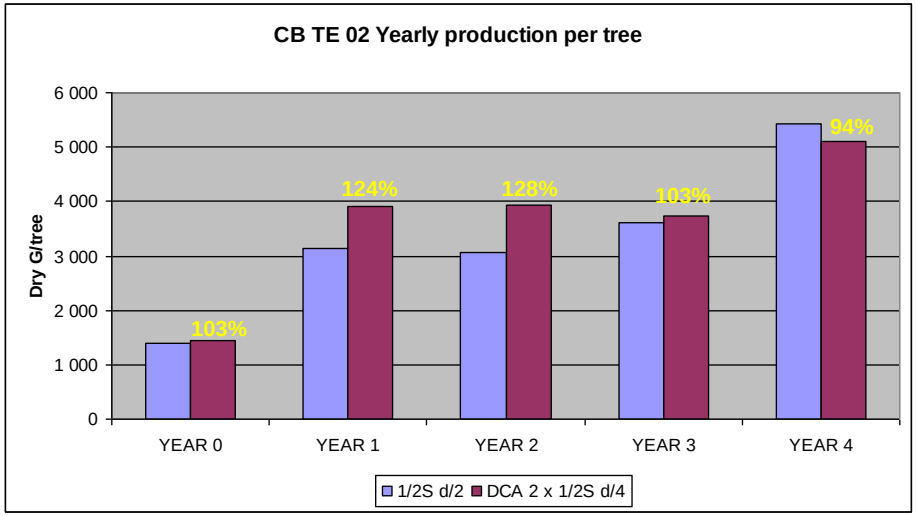
A – 1/2 S d/2 7d/7

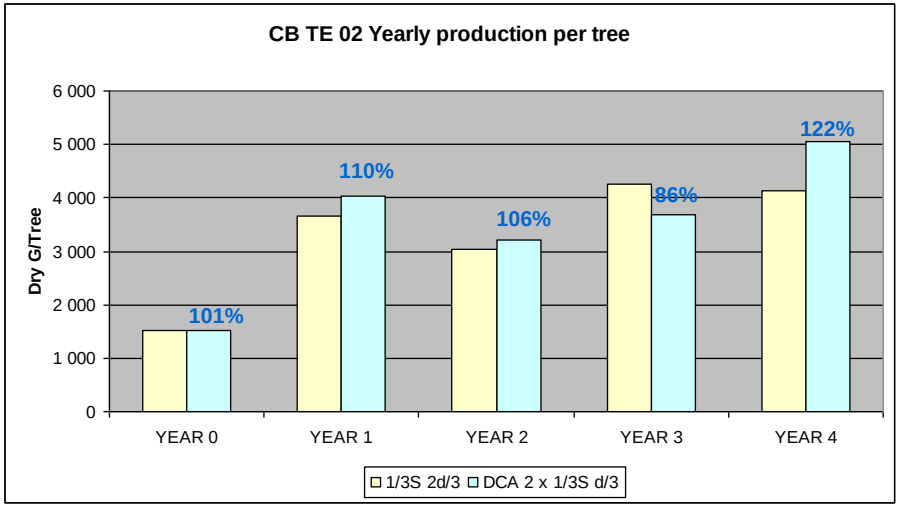
B – DCA 2 x 1/2 S d/4 7d/7 (t,t)

C – 1/3 S 2d/3 7d/7

D – DCA 2 x 1/3 S d/3 7d/7 (t,t)

DCA: Results Chantaburi (on-farm)





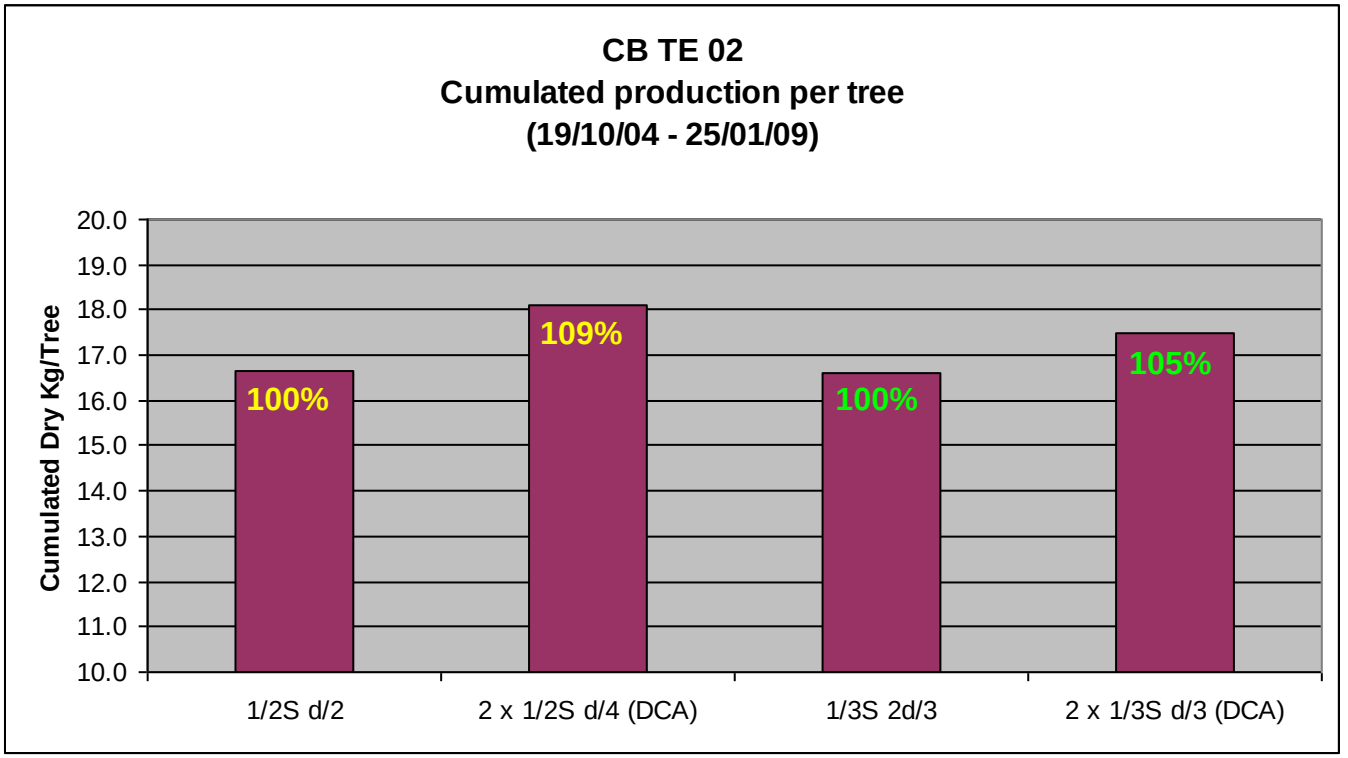
After 4 years + 3 months of tapping:

DCA equivalent to 1/2S d/2 provided a higher yield compared to control from Y0 to Y3 and slightly lower in Y4 (panel changed over)

DCA equivalent to 1/3S 2d/3 provided a higher yield in Y0 to Y2, lower in Y3 (panel changed over), then 22% higher in Y4

DCA: Results Chantaburi (on-farm)

Cumulative production after 4 years + 3 months of tapping:



DCA equivalent to 1/2S d/2 gave +9%

DCA equivalent to 1/3S 3d/2 gave +5%

DCA: on-farm trials at Songkhla
Experimental plots and treatments

Hurae, Hat Yai District

4 farmers **1 trial in 2007**
3 trials in 2008

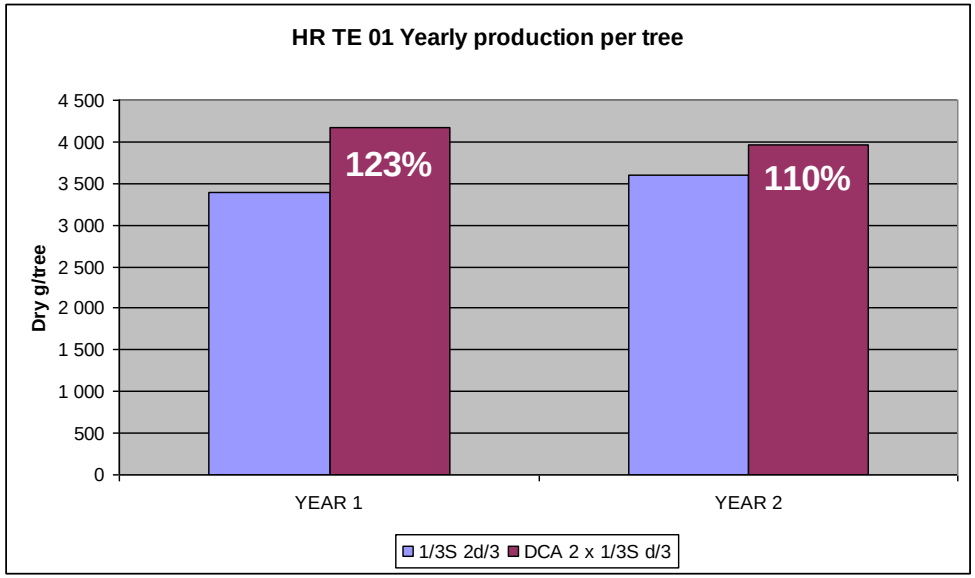
Tapping system: 1/3S 2d/3

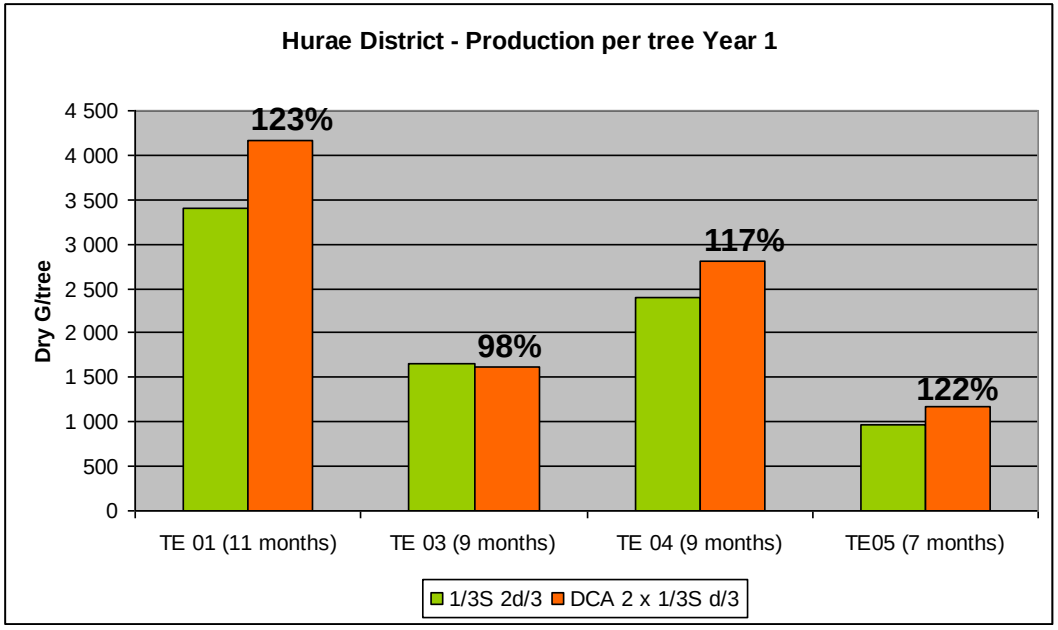
Namom District

4 farmers **1 trial in 2007**
3 trials in 2008

Tapping system: 1/3S 3d/4

DCA: Results Songkhla (on-farm at Hurae)

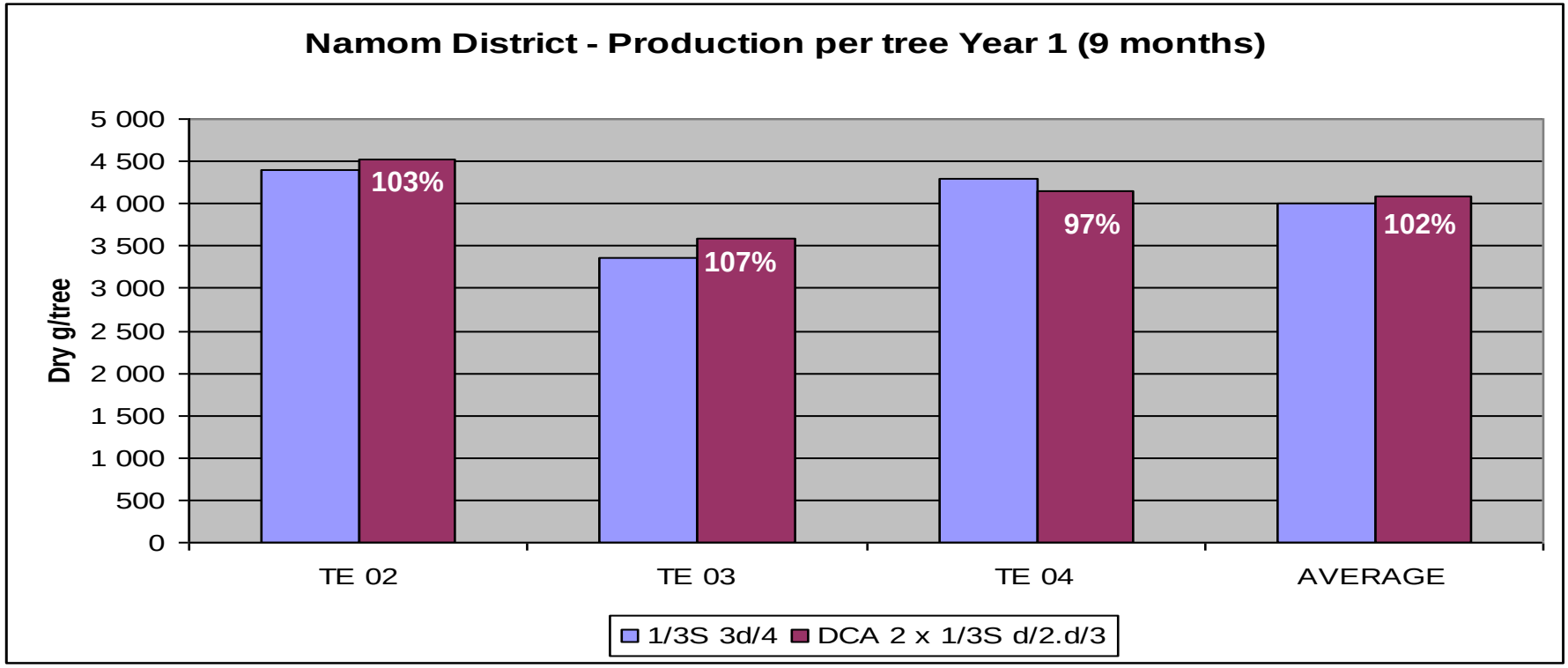




In the first trial, started in 2007, DCA system showed an higher yield per tree (+23% and +10%) compared to the current tapping system of the farmer, leading to an higher income

For all trials, DCA system in Year 1 provided higher yield (+17% to +23%) in 3 trials out of 4

DCA: Results Songkhla (on-farm at Namom)



At Namom district, where higher intensity tapping system (1/3S 3d/4) is currently used by the farmers, the yield improvement provided by DCA system in Year 1 is smaller.

DCA: Preliminary conclusions

8 years experiment at CRRC showed that

- DCA tapping system improved latex regeneration and subsequently increased output per tree and per tapping (+9% along 8 years)
- During the first seven years of tapping, cumulative rubber production was significantly increased compared to the equivalent intensity with single cut tapping system (1/2S d/2)
- DCA allowed in maintaining correct physiological profiles and a good relation between girth and production

DCA: Preliminary conclusions

On-farm experiments carried out in East Thailand (Chantaburi) and in the traditional area for growing rubber (South Thailand, Songkhla) confirmed the promising results already recorded with on-station experiments implemented from 2000 onwards at CRRC.

Chantaburi and Songkhla are the first locations where DCA tapping system is applied on high tapping frequencies (2d/3 and 3d/4) associated with a shortened tapping cut (1/3S)

Preliminary results showed that DCA could perform improvement of yield (g/tree), labor productivity (g/tree/tapping) and farmers income in most of cases

DCA: Preliminary conclusions

DCA system is efficient without any external input such as Ethephon stimulation.

The use of DCA system would not modify the tapping work organization on farms, since tapping frequencies would remain unchanged at tree scale. The tapping intensity is just shared on two cuts alternately instead of one single cut with conventional tapping systems.

DCA tapping strategy appears as the only current solution to increase production and/or labour productivity of rubber smallholdings using high tapping frequencies.

DCA: Preliminary conclusions

Nevertheless, it is still too early to envisage a recommendation of DCA tapping strategy on a large scale in Thailand rubber smallholdings.

The network of trials with farmers must be extended:

- **In Songkhla province**
- **In other Southern provinces (traditional area)**
- **In North-East provinces (non traditional area)**

Long run and multi-sites evaluation of the system is necessary in order to validate its feasibility and sustainability.

Thank you for your attention

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